

REMARKS

In the Office Action, dated November 1, 2002, the Examiner states that Claims 1-6 and 8-28 are pending, and Claims 1-6 and 8-28 are rejected. By the present Amendment, Applicant amends the claims.

In the Office Action, Claims 1-6, 10-11, 14 and 16-28 are rejected under 35 U.S.C. §102(e) as anticipated by US 6,399,257 (Shirota). The Applicant maintains the argument that US 6,399,257 is not a proper reference which may be cited against the claims under §102(e), and submits the attached certified translation of the Japanese priority document.

In the Office Action, Claims 18-21 are rejected under 35 U.S.C. §102(e) as anticipated by WO 99/08158, because those claims do not exclude the presence of a shading part on the color filter. The Applicant has amended those claims to state that a shading part is not formed on a border part of a picture element part. This is not disclosed by WO 99/08158, and therefore the rejection is considered overcome.

In the Office Action, Claims 1-6 and 8-28 are rejected under 35 U.S.C. §103(a) as unpatentable over WO 99/08158 in view of EP 0665 449. The Applicant respectfully disagrees with this rejection.

As mentioned in the last Amendment, the present invention relates to a color filter which does not have a shading part (black matrix). The present invention solves the difficult problem of forming a picture element part with high precision with an ink jet system on a substrate, without forming the shading part.

To solve this problem the present invention uses a photocatalyst-containing layer and a wettability-variable layer. By altering the wettability of the wettability-variable layer by irradiating it through the photocatalyst-containing layer with energy, a picture element part is formed with high precision with an ink jet system without a shading part being formed.

In contrast, all the color filters described in the cited reference WO 99/08158 (WO' 158) have shading parts, and there is no description about a color filter without a shading part. Furthermore, although EP 0665 449 discloses examples of color filters without a black matrix in lines 23-37 of page 9, Fig. 10A-10E, and Fig. 12, all of

these examples relate to an absorbing layer which forms a picture element part by absorbing ink, and does not pattern the picture element part by changing the wettability.

Because the present invention uses a photocatalyst-containing layer, the wettability of the wettability-variable layer can be effectively changed by irradiating it with energy. Therefore, an extremely large difference of the wettability can be obtained in an allowable time for industrial production. Only by forming such a big difference in the wettability, may a picture element part be formed with enough high precision with an ink jet system on a flat penetrate substrate, without a shading part. This is not obvious even if WO 99/08158 and EPO 665 449 are combined.

In light of the foregoing response, all the outstanding objections and rejections have been overcome. Applicant respectfully submits that this application should now be in better condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,

2/28/03

Date

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Masato Okabe et al.

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SERIAL NO: 09/607,010

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TITLE: Color Filter and Process for Producing the Same

THE ASSISTANT COMMISSIONER FOR PATENTS

Washington, D.C. 20231

AMENDED CLAIMS

1. (Previously amended) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, the picture element part provided on the transparent substrate by a pattern of a plurality of colors with an ink jet system, and a photocatalyst-containing layer, provided for forming the picture element, including at least a photocatalyst and a binder, and having the wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation.
2. (Previously amended) The color filter according to Claim 1, wherein the photocatalyst-containing layer is provided on the transparent substrate, and the picture element part is provided on the photocatalyst-containing layer.
3. (Original) The color filter according to Claim 2, wherein a space between the picture element parts is not more than $2 \mu\text{m}$.
4. (Original) The color filter according to Claim 2, wherein an ink-repellent convex part is formed on the wettability variable layer at a boundary portion of the picture element part.
5. (Previously amended) The color filter according to Claim 1, wherein the picture element part is provided on the transparent substrate, and the photocatalyst-containing layer is provided on a border portion between the picture element parts.
6. (Original) The color filter according to Claim 5, wherein a wettability on the transparent substrate is less than 10 degrees in terms of the contact angle with a liquid having the surface tension of 40 mN/m.
7. (Previously cancelled).

8. (Previously amended) The color filter according to Claim 1, wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation.
9. (Original) The color filter according to Claim 8, wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy.
10. (Previously amended) The color filter according to Claim 1, wherein the photocatalyst is one or more substances selected from the group consisting of titanium oxide (TiO_2), zinc oxide (ZnO), tin oxide (SnO_2), strontium titanate ($SrTiO_3$), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3) and iron oxide (Fe_2O_3).
11. (Original) The color filter according to Claim 10, wherein the photocatalyst is titanium oxide (TiO_2).
12. (Original) The color filter according to Claim 11, comprising the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer at a rate of 500 or more relative to 100 of Ti element as determined by an X-ray photoelectron spectroscopy.
13. (Previously amended) The color filter according to Claim 1, wherein the binder is organopolysiloxane having a fluoroalkyl group.
14. (Previously amended) The color filter according to Claim 1, wherein the binder is organopolysiloxane which is a hydrolyzed and condensed compound or co-hydrolyzed and condensed compound of one or more of silicon compounds represented by $Y_nSiX_{(4-n)}$ wherein Y represents alkyl group, fluoroalkyl group, vinyl group, amino group, phenyl group or epoxy group, X represents alkoxy group or halogen, and n is an integer of 0 to 3.
15. (Original) The color filter according to Claim 14, wherein a silicon compound having a fluoroalkyl group among the silicon compounds constituting the organopolysiloxane is contained at an amount of 0.01 mol% or more.
16. (Previously amended) The color filter according to Claim 1, wherein a contact angle with a liquid having the surface tension of 40 mN/m on the photocatalyst-

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containing layer is not less than 10 degrees at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

17. (Previously amended) The color filter according to Claim 1, wherein the picture element part colored with an ink jet system is a picture element part colored with an ink jet system using a UV-curing ink.

18. (Currently amended) A process for producing a color filter, in which a shading part is not formed on a border part of a picture element part, which comprises:

a step of providing a photocatalyst-containing layer having a wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

a step of forming an exposed part for a the picture element part by pattern-irradiating with the energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

a step of coloring the exposed part of a the picture element part with an ink jet system, to form a the picture element part.

19. (Original) The process for producing a color filter according to Claim 18, wherein the step of forming an exposed part for a picture element part, then coloring the part with the ink jet system to form the picture element part, comprises steps:

a step of forming an exposed part for a first picture element part by pattern-irradiating with the energy on a part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed;

a step of forming the first picture element part by coloring the exposed part for a first picture element part with the ink jet system;

a step of forming an exposed part for a second picture element part by irradiating with the energy on a remaining part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed; and

a step of forming the second picture element part by coloring the exposed part for a second picture element part with the ink jet system.

20. (Original) The process for producing a color filter according to Claim 18, wherein an exposed part for an ink-repellent convex part is to be formed, is formed before formation of the exposed part for a picture element part, then the ink-repellent

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convex part is formed on the exposed part for an ink-repellent convex part through using resin composition.

21. (Original) The process for producing a color filter according to Claim 20, wherein the ink-repellent convex part is formed between the picture element parts.

22. (Currently amended) A process for producing a color filter in which shading part is not formed on a border part of a picture element part, which comprises:

a step of providing a photocatalyst-containing layer having a wettability of an energy irradiated part which changes in a direction of reduction of a contact angle with a liquid, at a boundary portion of a picture element part forming portion on which the picture element part is to be formed, on a transparent substrate; and

a step of forming the picture element part on the picture element part forming portion on the transparent substrate.

23. (Original) The process for producing a color filter according to Claim 22, wherein the wettability on the transparent substrate is less than 10 degrees as a contact angle with a liquid having the surface tension of 40 mN/m.

24. (Original) The process for producing a color filter according to Claim 18, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

25. (Original) The process for producing a color filter according to Claim 22, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

26. (Original) The process for producing a color filter according to Claim 18, wherein a coloring of the exposed part for a picture element part with the ink jet system is the coloring with the ink jet system using a UV-curing ink.

27. (Previously amended) The process for producing a color filter according to Claim 22, wherein a coloring of an exposed part for a picture element part with an ink jet system is the coloring with the ink jet system using a UV-curing ink.

28. (Original) A liquid crystal panel comprising a color filter according to Claim 1 and a substrate, which are opposite to the color filter, and provided a shading part, wherein a liquid crystal compound is encapsulated between both substrates.

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